FOT OPERATIONS CONFIGURATION MANAGEMENT

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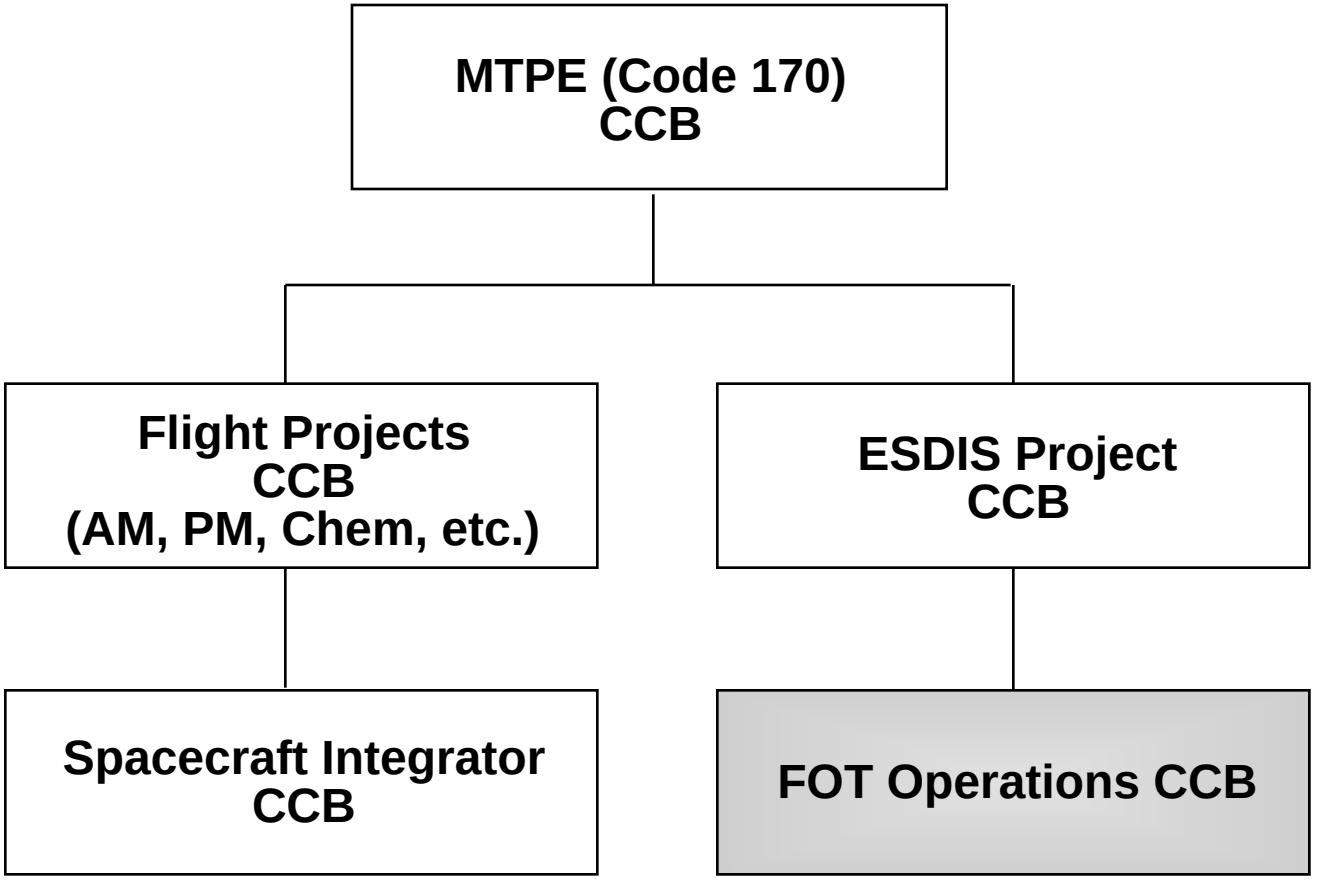
Topics

- Overview of MTPE Configuration Management
- Operations Configuration Management
- Operations Configuration Items
- Operations CCB
- Transfer of CIs From Valley Forge to EOC
- Additional Topics

Overview of MTPE Configuration Management



FOT Operations Configuration Management

- Reviews, updates, and controls operational CIs
- Tracks and controls configuration changes to CIs necessitated by changes in spacecraft operations
- Ensures PDB verification and validation of telemetry, commands, activities, and constraints
- Ensures verification and validation of each spacecraft command

FOT Operations Configuration Items Description

- CI data files used by operations to configure and control ground system (FOS) and spacecraft
- CIs configuration controlled by Operations CCB
- CIs built at EOC User Workstations or IST Workstations by FOT/ IOT personnel using FOS provided tools
  - Spacecraft/Ground: FOT
  - Instruments: IOT
- Categories
  - Spacecraft bus
  - Instruments
  - Ground

FOT/IOT CI List

- CIs that can be created from IST and are under FOT configuration control
  - PDB – Commands, Telemetry, Activities,* and Constraints
  - Baseline Activity Profile*
  - ECL Command Procedures*
  - Displays – Pages and Rooms (select group)*
  - Relative Time Command Sequence
  - Derived Parameters (pseudo A mnemonics – simple equations)
  - Algorithms (pseudo B mnemonics – complex equations)
  - Inhibit Identifiers (commands, RTCSs, TMONs)

*FOS Release A capability (January 1997)

FOT CI List

- CIs under FOT configuration control
  - FOS configuration definitions – User ID, passwords, constants, event messages, etc.
  - TMON
  - Flight Software
    - » Code
    - » Tables (SCC, CTIU, SSST)
  - Decision Support System

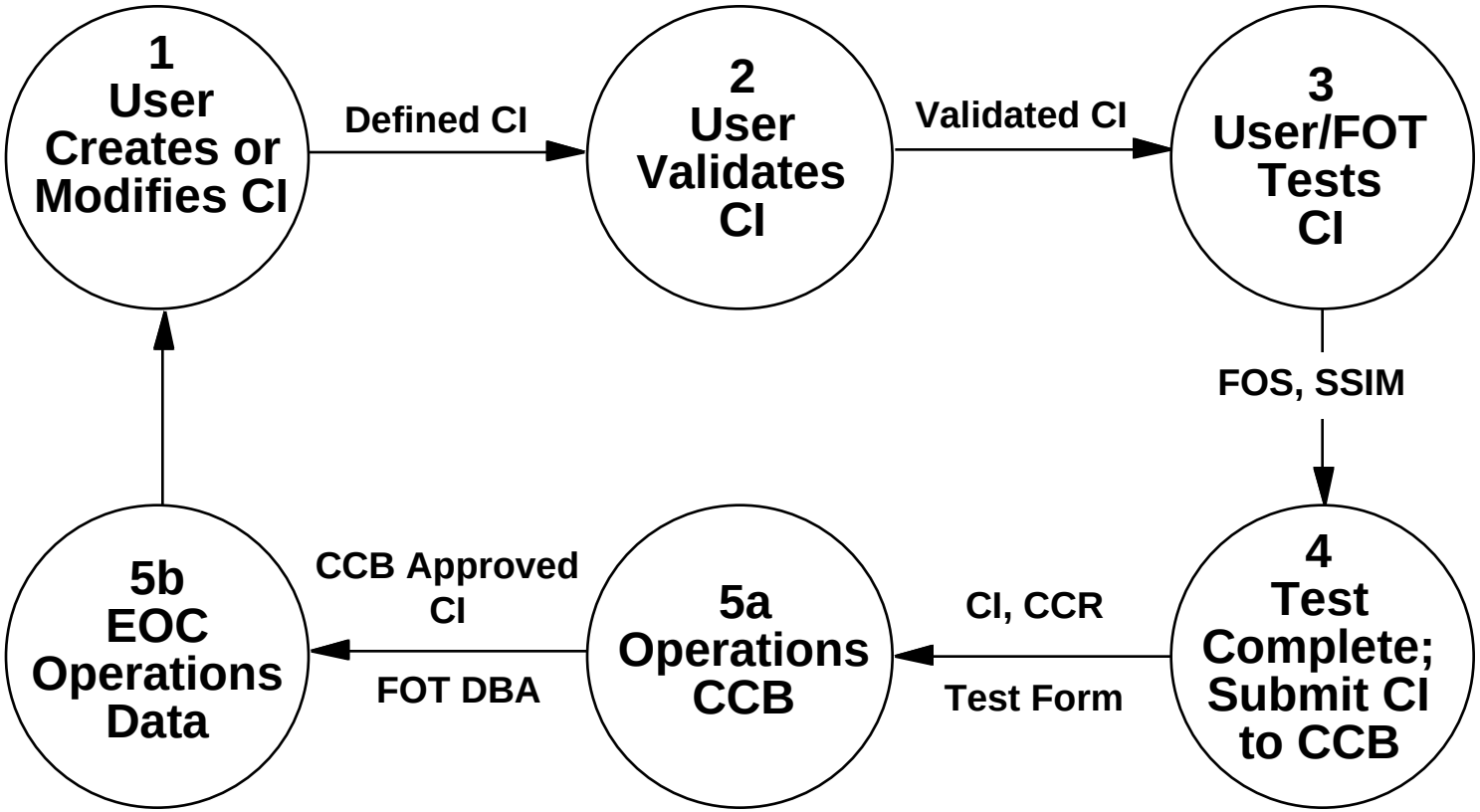
FOT Operations CI Development Process: Migration Path

1. User defines CI in his/her own personal account (IST Workstation or EOC User Workstation)
2. User validates syntax and constraints
3. User/FOT tests CI
   - Against FOS
     - » Example 1: Page display
     - » Example 2: Create activity, schedule activity, display on timeline, generate DAS and CMS loads
   - Against SSIM (e.g., command procedure)
4. User submits CI to Operations CCB for review

5a, 5b. Approved CIs migrated to EOC operations area by FOT DBA

   - Select group of CIs used by FOT/IOT to fly mission

Operations CI Flow Diagram



Operations CCB

- Author submission
  - CI listing (report)
  - Operational CCR
  - Validation test form
- Formal approval of new or modified CI requires four signatures
  - Author
  - NASA FOD (demonstrates review of CI and concurrence that functional implementation is consistent with subsystem engineering design)
  - FOT Operations Manager (demonstrates review of CI and consistency with ground system and operations plan)
  - FOT Flight Systems Engineer Manager (demonstrates that CI is consistent with current technical subsystem understanding and its interaction with other spacecraft subsystems)

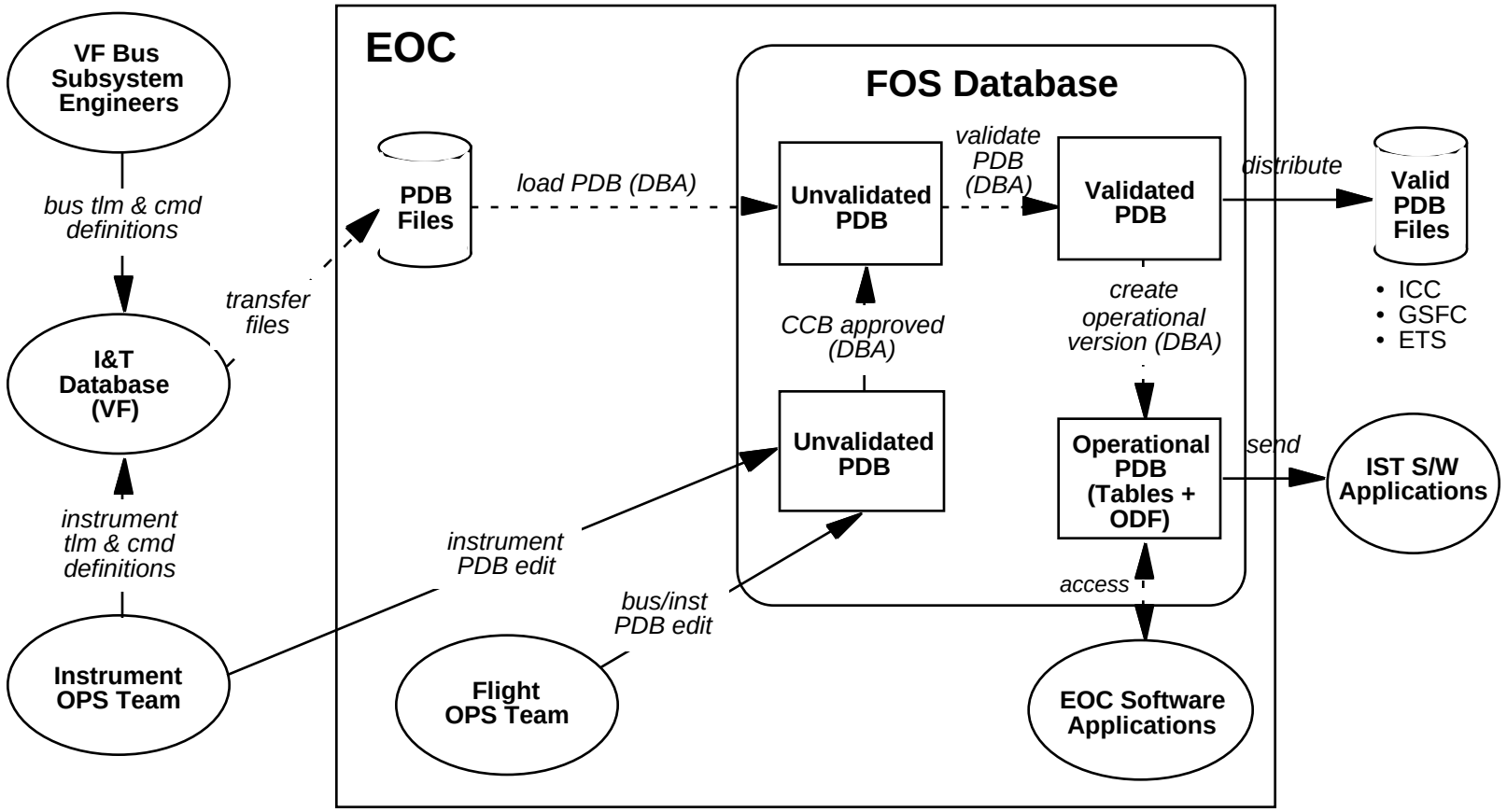
Transfer CIs: VF I&T to EOC Environment

- PDB (commands and telemetry only)
- Command procedures
  - Command prerequisite checks
  - Command constraints
  - Telemetry pseudo mnemonics
- Displays, RTCSs, and FSW Tables
- TMONs

FOT PDB Operations Concept

- PDB processing
  - Ingest
  - Edit [FOT, IOT, Database Administrator (DBA)]
  - Validation
    - » Syntax checking
    - » Verification of values
    - » Cross-checking of related definition files
  - Operational data generation
  - Reports
- CCB approves all PDB modifications
- DBA
  - Maintains error log
  - Performs backup and recovery
  - Incorporates PDB modifications
  - Generates PDB ingest, validation, and operational data

PDB Processing



PDB Interface

- FOT/IOT will have capability to
  - Access PDB
  - Submit updates and report on spacecraft (bus, instruments) information maintained in PDB
- From World Wide Web
  - Commands and telemetry
  - Web address: http://elmyra.hitc.com/FosDbDev.html
- From IST
  - Activities and constraints
- Access control to PDB will be provided through user accounts

EOC PDB Validation With Valley Forge

- Commands
  - FOT's goal is to verify each command (as appropriate) against
    - » Spacecraft Checkout Station
    - » SSIM
    - » AM-1 spacecraft
- Telemetry
  - AM-1 spacecraft: VF sends telemetry to EOC during I&T testing (shadow)
  - SSIM

EOC Command Procedures Transfer

- **Process: Integration and test (I&T) PROC (CSTOL) to Operations PROC (ECL)**
  - **VF transfers I&T Operations and Science Instrument Support (OASIS) command procedures to EOC**
  - **FOT uses FOS tool to import and convert I&T procedures**
    - » **Syntax conversion only**
    - » **OASIS directives not directly converted to ECL directives will be flagged**
    - » **FOT responsible for correcting unconverted directives**

EOC Command Procedures: Tailoring for Operations Environment

- FOT/IOT evaluates spacecraft I&T command procedures
  - Command prerequisite checks placed in PDB
  - Command constraints placed in PDB
  - Telemetry pseudo mnemonics
    - » Simple equations placed in PDB as Derived Parameters
    - » Complex equations converted to Algorithms
  - Modify for operations (10-minute contacts)
  - VF subsystem engineer and IOTs must reverify and sign off procedures

EOC Displays, RTCSs, and Tables

- Displays
  - VF I&T transfers OASIS displays used during I&T testing to EOC
  - FOT creates displays at EOC via FOS tool
- RTCS
  - RTCSs transferred from I&T to EOC
  - FOT/IOT creates and manages RTCS via FOS tool
  - FOT create loads and manages inhibit IDs
- Tables
  - VF extracts Tables from FSW and places Table entries into PDB format
  - Tables transferred from I&T to EOC
  - Tables loaded into PDB

EOC Telemetry Monitors

- TMONs transferred from SDVF to EOC
- FOT
  - Creates and manages TMONs using tool provided by SDVF
  - Manages Inhibit IDs
  - Tests TMONs against SSIM
  - Submits TMONs to SDVF for review
  - Submits SDVF-validated TMON to Operations CCB for approval
  - Creates loads
- SDVF
  - Tests and validates TMON
  - Creates load and Command Procedure for uplink
  - Oversees uplink

Additional Topics

- Constraints
- Inhibit Identifiers
- Decision Support System

EOC Constraints

- Activity and Command-Level Constraints defined for instruments, bus subsystems components
- Source of Constraints
  - AM-1 subsystem engineers
  - AM-1 I&T engineers
  - AM-1 I&T procedures
  - AM-1 documents
    - » Spacecraft Flight Systems Manual (bus)
    - » Operations Interface Control Documents (instruments)
  - FOT/IOT personnel

Inhibit Identifiers

- Inhibit Identifiers are flags (256) used by flight software to indicate whether or not commands for this group are to be inhibited
- Where defined
  - Command level → PDB
  - RTCS → FOS configuration file
  - TMON → SDVF tool
- How managed
  - Under Operations CCB control
  - Assign ranges to each instrument and bus subsystem

Decision Support System

- DSS is a rule-based expert advisor
  - Monitors behavior of parameters (spacecraft and ground)
  - Detects anomalies
  - Recommends recovery
- DSS design allows FOT to define both Rules and States
- FOT will populate and maintain DSS with information provided by the experts
  - VF subsystem engineers
  - VF I&T
  - IOT/FOT
  - Documents
  - FDF, EDOS, and NCC

Decision Support System (Cont'd)

- Knowledge base (rules and states) will be controlled by Operations CCB
- DSS will be tested using
  - SSIM
  - ETS
  - Spacecraft
    - » First on backup FOS (ground system) string
    - » If passes, then real-time string
- Spacecraft examples
  - Monitor telemetry
  - SSR management
  - Activity Log management
- Ground example: Communications link monitoring (CODAs and ODMs)

FOT DSS Concern

Use of DSS will result in long-term cost savings and increased operational efficiency; however

- **Population and operational implementation of DSS is labor intensive**
- **Requires personnel with comprehensive subsystem knowledge base; cost and staffing implications are being addressed**